

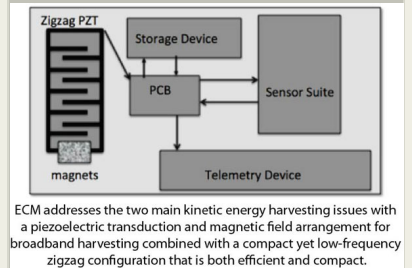
Compact Energy Conversion Module, Phase I

Completed Technology Project (2014 - 2014)



Project Introduction

This STTR project delivers a compact vibration-based Energy Conversion Module (ECM) that powers sensors for purposes like structural health monitoring (SHM). NASA customers include the ISS and the Orion deep space vehicle, both of which need wireless sensors to monitor and assess structural health. The ECM represents a significant advancement in the use of wireless and self-powered devices by enabling the miniaturization of vibration-based energy harvesting devices suitable for powering sensors. Implications of the innovation There exist two basic problems in reducing the size of vibration-based harvesters that plague all current commercially available devices—both are addressed here. The first is addressed by eliminating the problem of frequency matching in compact devices. The second is addressed by providing a broadband device capable of energy conversion across a range of frequencies. Technical objectives Our initial prototype is a TRL 4 unit that we used to demonstrate our ability to convert kinetic energy to useful electrical power. This prototype combines piezoelectric beam type transducers with artificially induced magnetic fields to force a nonlinear broadband behavior. Phase I shows feasibility through experimental tests and theoretical models that will establish that we can use this approach for compact sizing of low center frequency transducers. Research description Phase I transforms our prototype into a compact system and performs a variety of engineering feasibility tests under both typical ambient kinetic environments and the more high intensity environments that might be found in propulsion testing and launch facilities. Anticipated results Anticipated results include a reduction in the amount of battery waste generated by self-powered electronic devices that enables long-term wireless deployment. Phase I completes a TRL 5 prototype and validates system performance in relevant vibration environments. Phase II delivers a TRL 7 unit.



Compact energy conversion module Project Image

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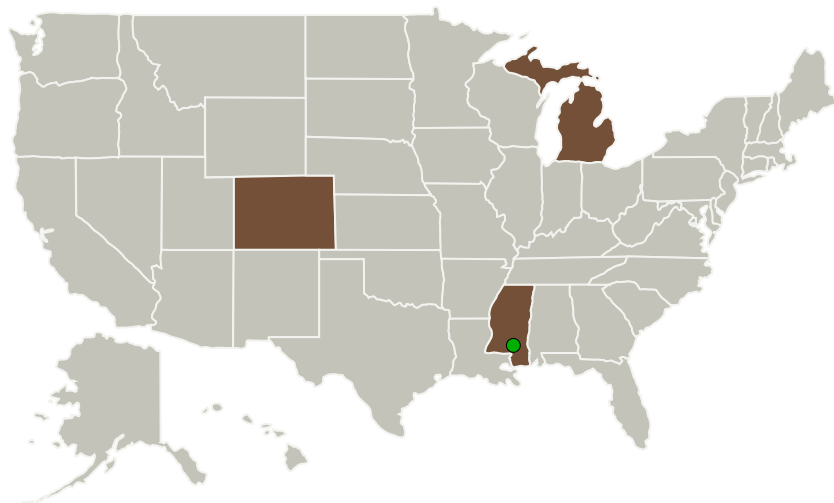
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Extreme Diagnostics, Inc.	Lead Organization	Industry	Boulder, Colorado
● Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Primary U.S. Work Locations

Colorado	Michigan
Mississippi	

Project Transitions

▶ **June 2014:** Project Start

✓ **December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140629>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Extreme Diagnostics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert B Owen

Co-Investigator:

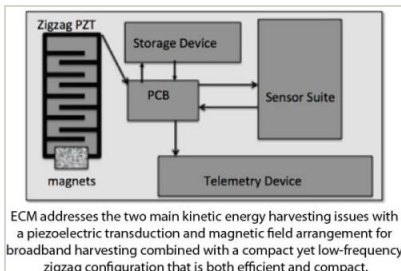
Robert Owen

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Images

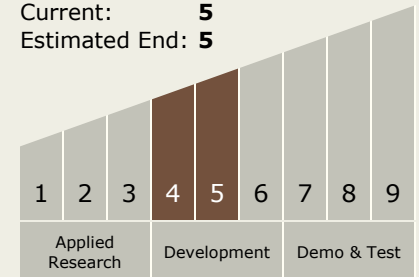


Project Image

Compact energy conversion module
Project Image
(<https://techport.nasa.gov/image/134203>)

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - TX03.1 Power Generation and Energy Conversion
 - TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System